TECHNOLOGY EDUCATION CURRICULUM FRAMEWORK

Connecticut State Department of Education
Division of Teaching and Learning
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TECHNOLOGY EDUCATION

By the end of Grade 12, students will know about the nature, power, influence and effects of technology, and will be able to design and develop products, systems and environments to solve problems.

PROGRAM GOALS

As a result of education in Grades K-12, students will:

- evaluate the effects of existing and emerging technologies on people and the environment over time;
- recognize the scope of technology and evaluate the impact and influence technology has on society, culture and the environment – past, present and future;
- develop and use strategies for adjusting to new technologies and changing interactions among science, technology and society;
- develop cognitive and psychomotor problem-solving skills through applied research, design, production, operation and analysis of technological systems (informational, physical and biological);
- safely and effectively use resources, processes, concepts and tools of technology;
- create devices for solving problems, using creativity and concepts of design and technology; and
- understand the influences of technology on consumer and career choices.

K-12 CONTENT STANDARDS

1.	**Economics**	Students will understand the link between technology and the economy, and recognize that link as the force behind societal emergence and evolution.
2.	**Technological Impacts**	Students will understand the impact that technology has on the social, cultural and environmental aspects of their lives.
3.	**Career Awareness**	Students will become aware of the world of work and its function in society, diversity, expectations, trends and requirements.
4.	**Problem Solving/Research and Development**	Students will recognize technology as the result of a creative act, and will be able to apply disciplined problem-solving strategies to enhance invention and innovation.
5.	**Leadership**	Students will identify and develop leadership attributes and apply them in team situations.
6.	**Materials and Processes**	Students will know the origins, properties and processing techniques associated with the material building blocks of technology.
7.	**Communications Systems**	Students will understand and be able to effectively apply physical, graphic and electronic communications techniques in processing, transmitting, receiving and organizing information.
8.	**Production Systems**	Students will understand and be able to demonstrate the methods involved in turning raw materials into usable products.
9.	**Transportation Systems**	Students will understand transportation systems and the environments used to move goods and people, and the subsystems common to each.
10.	**Enterprise**	Students will demonstrate the techniques of enterprise and how they relate to product and service production, economics, human and material resources, and technology.
11.	**Engineering Design**	Students will be able to apply the engineering design process to achieve desired outcomes across all technology content areas.

CONTENT STANDARD 1: Economics

Students will understand the link between technology and the economy, and recognize that link as the force behind societal emergence and evolution.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *business* and *industry;* and
- describe business and industry as producers of products or services.

Educational experiences in **Grades 5-8** will assure that students:

- describe how societies are organized to produce and distribute goods and services in a structured manner;
- describe how society uses resources and distributes its goods and services;
- describe how a business produces profit;
- describe the major economic and political systems in relation to technological activity;
- identify three types of businesses;
- describe free enterprise;
- discuss the global market/economy and understand its effects on the United States;
- analyze a product for its ability to satisfy consumer demands; and
- develop skills in making wise consumer decisions.

Educational experiences in **Grades 9-12** will assure that students:

- identify how the development and production of products and services are dependent on the transformation of available resources;
- identify current global, social and economic trends, and identify their relationship to computer-controlled production;
- describe the evolution of technological enterprise and its influence on the economy, culture, society and environment;
- describe the characteristics of single ownership, corporations, companies and partnerships; and
- compare and contrast ways of financing an enterprise.

CONTENT STANDARD 2: Technological Impacts

Students will understand the impact that technology has on the social, cultural and environmental aspects of their lives.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *technology*;
- describe how technology is used in familiar surroundings;
- describe how their actions can affect the environment;
- identify positive and negative impacts of technology;
- describe the role of technology in their lives;
- trace the historical development of a product or process of technology;
- define the role of technology in education, the family and the community; and
- identify an existing technology and describe how it could be used differently.

Educational experiences in **Grades 5-8** will assure that students:

- explain how technology and technological activity has expected and unexpected effects;
- develop criteria for evaluating technology;
- identify and describe how individual technological innovations may be combined to create new technologies;
- explore and identify the personal, societal, economic and environmental effects of technological systems;
- trace the historical development of at least one technology, identifying its effects and hypothesizing about its future;
- identify the social and economic impacts of automation and computer-controlled processing; and
- describe the universal input, process, output , feedback (IPOF) systems model.

Educational experiences in **Grades 9-12** will assure that students:

- forecast trends in communications, production, transportation and the bio-related technologies, and project their potential impacts;
- employ the input, process, output, feedback system model to their evaluation of technological impacts;
- evaluate technologies based on their positive and negative outcomes; and
- discuss societal and industrial responsibilities for using proper hazardous waste disposal techniques.

CONTENT STANDARD 3: Career Awareness

Students will become aware of the world of work and its function in society, diversity, expectations, trends and requirements.

K- 12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *work*, and identify how people earn a living;
- identify occupations that require working with people, places or things;
- describe how mathematics, science, language arts, social studies and the arts are related to technology;
- research and report on a technological career;
- define the role of mathematics, science, language arts, social studies, the arts and technology education in preparing for various careers; and
- describe how advances in technology have created new and emerging career options.

Educational experiences in **Grades 5-8** will assure that students:

- describe how technological development affects careers and occupations;
- demonstrate awareness of changes in job requirements over time;
- describe strategies for assuming responsibility;
- develop personal responsibility and accountability in the workplace;
- define and discuss personal and professional ethics;
- discuss coping strategies for change;
- identify expectations in the workplace;
- define and discuss the concept of "work ethic";
- explore career options;
- define and discuss "career path";

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Educational experiences in **Grades 9-12** will assure that students:

- identify career opportunities in the areas of transportation, communications, production and biotechnology;
- demonstrate an ability to take responsibility for their own actions;
- explain the need to be a lifelong learner;
- exhibit appropriate behaviors in both school and work situations;
- define and demonstrate a personal work ethic; and
- identify future labor market trends.

K- 12 PERFORMANCE STANDARDS, continued

Educational experiences in **Grades 5-8** will assure that students:

- prepare a preliminary career plan, with connections to high school course selections; and
- develop strategies for predicting labor market needs.

CONTENT STANDARD 4: Problem Solving/Research and Development

Students will recognize technology as the result of a creative act, and will be able to apply disciplined problem-solving strategies to enhance invention and innovation.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- identify and define a problem;
- describe different methods of problem solving;
- describe one problem-solving model;
- gather, record and organize data, based on observations;
- develop an action plan;
- evaluate a solution to a problem;
- communicate their solutions to problems with others; and
- identify a problem and use a problem-solving method to develop a solution.

Educational experiences in **Grades 5-8** will assure that students:

- differentiate between human problems and needs;
- define decision-making, research and invention;
- discuss how technological systems have been used to solve human problems;
- select and apply a general problem-solving model in a laboratory setting;
- identify research methods, materials and techniques;
- apply cooperative techniques while engaged in group problem-solving activities;
- engage in an activity that requires creativity;
- apply appropriate and effective questioning techniques;
- describe and apply the processes used to make decisions;

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Educational experiences in **Grades 9-12** will assure that students:

- use research techniques to support design development;
- apply the descriptive statistics of average, percentage, correlation and graphing to design outcomes;
- develop several alternative design solutions to the same problem;
- use a communication technology to visualize a design idea;
- know the laws related to copyrights, trademarks and patents;
- present a design idea using multimedia technology;
- prepare and document a design brief;
- select appropriate technical processes and fabricate a prototype;
- design and conduct a technical experiment; and

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K-12 PERFORMANCE STANDARDS, continued

Educational experiences in **Grades 5-8** will assure that students:	Educational experiences in **Grades 9-12** will assure that students:
• conduct an applied research project; • develop, test and modify a design idea through experimentation; • differentiate between invention and innovation; and • develop a solution for a real-life problem.	• apply biological materials and processes to solve a problem.

CONTENT STANDARD 5: Leadership

Students will identify and develop leadership attributes and apply them in team situations.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *team*;
- identify the role of various team members;
- describe a team within the school setting;
- evaluate the effectiveness of a team;
- organize a team to solve a teacher-given problem; and
- define the responsibility of each member of a work team.

Educational experiences in **Grades 5-8** will assure that students:

- create a simple flowchart of their daily activities;
- engage in presentation activities;
- identify the elements of interpersonal communication;
- identify and demonstrate organizational skills;
- explore different roles while working cooperatively and effectively in team situations;
- demonstrate strategies for effectively managing time;
- develop organizational skills through practical experiences; and
- explore different roles within a team environment.

Educational experiences in **Grades 9 -12** will assure that students:

- apply organizational skills to classroom and laboratory activities;
- develop a personal time management plan;
- assume roles within a team environment commensurate with their skills and expertise; and
- present information in a clear, concise and appropriate manner.

CONTENT STANDARD 6: Materials and Processes

Students will know the origins, properties and processing techniques associated with the material building blocks of technology.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- identify the characteristics of different resources and describe how these resources can serve different purposes;
- describe that, by processing resources, the resources can be used differently;
- select the appropriate tool for a given need;
- use tools and resources correctly and safely;
- identify technological resources as materials, people, time, money, information, tools, etc.; and
- describe how the processing of resources can produce a more useful product.

Educational experiences in **Grades 5-8** will assure that students:

- identify and describe a group of new and recycled materials used in technological systems;
- differentiate between primary and secondary raw materials;
- explore methods used to convert raw and recycled materials into usable products;
- demonstrate the appropriate selection and safe operation of basic hand and power tools;
- use manual and electronic measuring devices accurately;
- explore the principles of manual material-processing techniques;
- describe how products are manufactured;

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Educational experiences in **Grades 9-12** will assure that students:

- list the techniques used to extract raw materials from the environment;
- describe the physical structures and properties of materials used in technological systems;
- classify raw materials according to their physical and mechanical properties;
- distinguish between organic and inorganic materials;
- experiment with the alteration of material characteristics;
- differentiate between natural and artificial materials;
- research, plan and participate in recycling activities;
- identify secondary materials and processes through product analysis; and

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K-12 PERFORMANCE STANDARDS, continued

	Educational experiences in **Grades 5-8** will assure that students:	Educational experiences in **Grades 9-12** will assure that students:
	• demonstrate a working knowledge of the layout, shaping, smoothing, assembly and finishing techniques used to produce a product; • explore the principles of computer-controlled processing techniques; and • produce simple products from a variety of materials, using manual and computer-controlled devices.	• produce products with raw and recycled materials by separating, forming, combining, conditioning and finishing.

CONTENT STANDARD 7: Communications Systems

Students will understand and be able to effectively apply physical, graphic and electronic communications techniques in processing, transmitting, receiving and organizing information.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:	Educational experiences in **Grades 5-8** will assure that students:	Educational experiences in **Grades 9-12** will assure that students:
• define *technological system;*	• identify and give examples of integrated technologies;	• describe electronic publishing and give examples of this technology;
• identify the parts of a technological system;	• identify the elements of interpersonal communication;	• demonstrate the proper use of the terminology associated with electronic publishing, graphic arts and computers;
• use a technological system;	• identify the elements of mass communications;	• identify and describe component functions of a microcomputer electronic publishing system;
• describe the function of various systems;	• acquire technology-based information and apply it in classroom and laboratory situations;	• apply accepted design principles of text and graphics to the layout of printed and electronically published materials;
• describe the universal input, process, output, feedback (IPOF) system model; and	• explore and explain the integration of communication technologies into transportation and production systems;	• operate a scanner and digitize a video image using appropriate software;
• demonstrate an IPOF system.	• apply techniques of interpersonal and mass communication through activities such as sketching, computer-aided drafting (CAD), photography and video; and	• demonstrate skills in marketing printed products;
	• evaluate and select appropriate methods of communication for a given problem or situation.	• send and access information through a network;

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K-12 PERFORMANCE STANDARDS, continued

Educational experiences in **Grades 9-12** will assure that students:

- design and produce a video and multimedia production;
- capture a signal from an orbiting satellite;
- transfer information using laser transmission technology;
- communicate using fiber optic cables;
- operate a computer-aided drafting (CAD) system;
- generate a computer image of an object in 3D format;
- render an object to include texture, density, lighting and rotational movement; and
- export and import images in a variety of file forms.

CONTENT STANDARD 8: Production Systems

Students will understand and be able to demonstrate the methods involved in turning raw materials into usable products.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *technological system;*
- identify the parts of a system;
- use a technological system;
- describe the function of various systems;
- describe the input, process, output, feedback (IPOF) system model; and
- demonstrate an IPOF system.

Educational experiences in **Grades 5-8** will assure that students:

- define manufacturing terminology, including interchange ability, automation, standardization, etc.;
- describe how products are manufactured using the methods of single craftsman, line and mass, and automated-robotics manufacturing;
- identify and describe the tools, materials and methods used in manufacturing products;
- identify the characteristics of sub- and superstructures;
- identify and describe the tools, materials and methods used in constructing sub- and superstructures;
- design, construct and test models of shelters and other structures; and
- produce a product using a simple production sequence: layout, shaping, smoothing, assembly and finishing techniques.

Educational experiences in **Grades 9-12** will assure that students:

- describe the relationship between the universal systems model and production technology;
- differentiate between manufacturing and construction systems;
- trace the historical development of the construction industry;
- differentiate between residential and commercial construction systems;
- describe the significance of architectural drawings, specifications and contracts in the construction industry;
- describe and apply the process of site selection and preparation;
- demonstrate an ability to read and interpret architectural renderings;

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K-12 PERFORMANCE STANDARDS, continued

Educational experiences in **Grades 9-12** will assure that students:

- demonstrate the safe and accurate use of layout, forming, separating, combining, treating, and finishing tools and procedures in building a shelter or structure;
- identify, describe and apply the structural elements used in commercial floor, wall and roofing systems;
- identify and describe the nonstructural characteristics of plumbing, electrical and environmental systems used in construction;
- complete a cost estimation, create a critical path network, and construct a small full-scale shelter or structure;
- discuss advanced construction systems and the role they play in future societies;

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K-12 PERFORMANCE STANDARDS, continued

Educational experiences in **Grades 9-12** will assure that students:

- discuss the problems and possibilities of construction practices in the alternative environmental colonization settings of submarine, space and extra planetary;
- trace the historical evolution of manufacturing;
- discuss the advantages of environmentally conscious manufacturing;
- demonstrate an ability to safely and accurately use the layout, form, separate, combine, treat and finish tools and processes in manufacturing a product;
- distinguish between custom, just-in-time and flexible manufacturing techniques;
- generate and operate a computer numerical control (CNC) program;
- describe computer-integrated manufacturing (CIM); and
- describe space industrialization and list several products that are manufactured from secondary materials produced in a microgravity environment.

CONTENT STANDARD 9: Transportation Systems

Students will understand transportation systems and the environments used to move goods and people, and the subsystems common to each.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *technological system;*
- identify the parts of a system;
- use a technological system;
- describe the function of various systems;
- describe the input, process, output, feedback (IPOF) system model; and
- demonstrate an IPOF system.

Educational experiences in **Grades 5-8** will assure that students:

- differentiate between vehicular and stationary transportation systems;
- differentiate between fixed and random-route land transportation systems;
- describe and be able to identify the transportation subsystems of body/frame, propulsion, suspension, control, guidance and support in a variety of transportation devices;
- explore the characteristics of lighter than air and heavier than air atmospheric transportation systems;
- apply the concept of transportation subsystems while solving transportation problems;
- identify and experiment with devices used to protect product and personnel in transportation systems; and
- explore, build and experiment with model marine, space, land and air transportation systems.

Educational experiences in **Grades 9-12** will assure that students:

- identify and describe the historical innovations in the evolution of transportation systems and their impact on our society, economy and environment;
- understand the principles of aerodynamics;
- design, fabricate, test and evaluate a land, atmospheric, marine and space transportation system;
- identify and explore solutions to future global transportation problems;
- explore and experiment with traditional and alternative fuels; and
- describe how pneumatic, hydraulic, mechanical and electrical energy are used in transportation systems.

CONTENT STANDARD 10: Enterprise

Students will demonstrate the techniques of enterprise and how they relate to product and service production, economics, human and material resources, and technology.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- identify various local businesses and industries as producers of goods or services; and
- create a mock business within the classroom or school.

Educational experiences in **Grades 5-8** will assure that students:

- describe the evolution of technological enterprise;
- discuss the influence of enterprise on culture, society and the environment;
- define the terms *single ownership*, *company*, *corporation* and *partnership*;
- explore the career possibilities and responsibilities in enterprise;
- identify and explore a variety of organizational structures, describing the advantages and disadvantages of each;
- explore market research and its relationship to satisfying consumer needs; and
- develop, distribute and evaluate a customer survey.

Educational experiences in **Grades 9-12** will assure that students:

- design a simulated enterprise and participate in a variety of roles within the organizational structure;
- explore company responsibilities toward employees, community and the environment;
- discuss the current and historical significance of unions;
- design a product based on customer need, available materials, tools, equipment and fiscal resources;
- develop a floor diagram and flowchart;
- define and use the quality control measures of pre-inventory inspection, statistical process control and total quality management;
- discuss the required modifications if a product were to be manufactured in a nontraditional environment;

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K-12 PERFORMANCE STANDARDS, continued

Educational experiences in **Grades 9-12** will assure that students:

- calculate the cost of producing a manufactured product and determine a retail price; and
- develop a marketing plan and successfully distribute a product.

CONTENT STANDARD 11: Engineering Design

Students will be able to apply the engineering design process to achieve desired outcomes across all technology content areas.

K-12 PERFORMANCE STANDARDS

Educational experiences in **Grades K-4** will assure that students:

- define *design*; and
- construct, evaluate and modify a model or prototype.

Educational experiences in **Grades 5-8** will assure that students:

- identify the elements of design;
- discuss the differences between problem solving and engineering design strategies;
- explain the role of creativity in the engineering design process;
- describe conceptual design, embodiment design and detail design and identify their roles in the engineering process;
- explore a variety of creativity-enhancing techniques;
- develop conceptual designs for transportation, communications, production and bio-related problems;
- use a variety of creativity-enhancing techniques in conceptual design situations;
- explore techniques used to refine conceptual design sketches; and
- develop preliminary product layouts.

Educational experiences in **Grades 9-12** will assure that students:

- differentiate between the problem solving and engineering design processes;
- describe the detail design phase of the engineering design process;
- demonstrate an ability to complete a detail design for any given embodiment design;
- apply a variety of creativity-enhancing techniques in completing a conceptual, embodiment and detail design solution; and
- apply the full engineering design process to produce a product on time t**hat meets all initial criteria, using appropriate tools and material resources.